

227. Schneider F, Gur RC, Koch K, Backes V, Amunts K, Shah NJ, Bilker W, Gur RE, Habel U. Impairment in the specificity of emotion processing in schizophrenia. American Journal of Psychiatry. 2006, 163, 442-447.
228. Siegel SJ, Irani F, Brensinger CM, Kohler CG, Bilker WB, Ragland JD, Kanes SJ, Gur, RC, Gur RE. Prognostic variables at intake and long-term level of function in schizophrenia. American Journal of Psychiatry, 2006, 163, 1-9.
229. Ragland JD, McCarthy E, Bilker WB, Brensinger CM, Valdez J, Kohler C, Gur RE, Gur RC. Levels-of-processing effect on internal source monitoring in schizophrenia. Psychological Medicine. 2006, 36, 641-648.
230. Gur RE, Kohler CG, Ragland JD, Siegel SJ, Lesko K, Bilker WB, Gur RC. Flat affect in schizophrenia: Relation to emotion processing and neurocognitive measures. Schizophrenia Bulletin, 2006, 32, 279-287.
231. Silver H, Goodman C, Bilker W, Gur RC, Isakov V, Knoll G, Feldman P. Impaired error monitoring contributes to face recognition deficit in schizophrenia patients. Schizophrenia Research. 2006, 85, 151-161.
232. Dickinson D, Ragland JD, Calkins ME, Gold JM, Gur RC. A comparison of cognitive structure in schizophrenia patients and healthy controls using confirmatory factor analysis. Schizophrenia Research. 2006, 85, 20-29.
233. Irani F, Platek SM, Panyavin IS, Calkins ME, Kohler C, Siegel SJ, Schachter M, Gur RE, Gur RC. Self-face recognition and theory of mind in patients with schizophrenia and first-degree relatives. Schizophrenia Research. 2006, 88, 151-160.
234. Sanders RD, Joo YH, Almasy L, Wood J, Keshavan MS, Pogue-Geile MF, Gur RC, Gur RE, Nimgaonkar VL. Are neurologic examination abnormalities heritable? A preliminary study. Schizophrenia Research. 2006, 86, 172-180.
235. Moberg PJ, Arnold SE, Doty RL, Gur RE, Balderston CC, Roalf DR, Gur RC, Kohler CG, Kanes SJ, Siegel SJ, Turetsky BI. Olfactory functioning in schizophrenia: Relationship to clinical, neuropsychological, and volumetric MRI measures. Journal of Clinical and Experimental Neuropsychology, 2006, 28, 1444-1461.
236. Weiss EM, Kohler CG, Brensinger CM, Bilker WB, Loughhead J, Delazer M, Nolan KA. Gender differences in facial emotion recognition in persons with chronic schizophrenia. Eur Psychiatry. 2007, 22, 116-122.
237. Aliyu MH, Calkins ME, Swanson CL Jr, Lyons PD, Savage RM, May R, Wiener H, McLeod-Bryant S, Nimgaonkar VL, Ragland JD, Gur RE, Gur RC, Bradford LD, Edwards N, Kwentus J, McEvoy JP, Santos AB, McCleod-Bryant S, Tennison C, Go RC, Allen TB; PAARTNERS Study Group. Project among African-Americans to explore risks for schizophrenia (PAARTNERS): recruitment and assessment methods. Schizophr Res. 2006; 87:32-44. Erratum in: Schizophr Res. 2007; 90:369.

238. Kohler CG, Barrett FS, Gur RC, Turetsky BI, Moberg PJ. Association between facial emotion recognition and odor identification in schizophrenia. J Neuropsychiatry Clin Neuroscience. 2007, 19, 128-131.
239. Gur RE, Turetsky BI, Loughhead J, Snyder W, Kohler C, Elliott M, Pratiwadi R, Ragland JD, Bilker WB, Siegel SJ, Kanes SJ, Arnold SE, Gur RC. Visual attention circuitry in schizophrenia investigated with oddball event-related functional magnetic resonance imaging. American Journal of Psychiatry. 2007, 164, 442-449.
240. Moser E, Derntl B, Robinson S, Fink B, Gur RC, Grammer K. Amygdala activation at 3T in response to human and avatar facial expressions of emotions. Journal of Neuroscience Methods. 2007, 161, 126-133.
241. Gur RC, Turetsky BI, Loughhead J, Waxman J, Snyder W, Ragland JD, Elliot M, Bilker WB, Arnold SE, Gur RE. Hemodynamic responses in neural circuitries for detection of visual target and novelty: An event-related fMRI study. Human Brain Mapping. 2007, 28, 263-274.
242. Wolf DH, Gur RC, Valdez JN, Loughhead J, Elliott MA, Gur RE, Ragland JD. Alterations of fronto-temporal connectivity during word encoding in schizophrenia. Psychiatry Reseach. 2007, 15, 221-232.
243. Gur RE, Calkins M, Gur RC, Horan W, Nuechterlein K, Seidman L, Stone W. The Consortium on the genetics of schizophrenia (COGS): Neurocognitive Endophenotypes. Schizophrenia Bulletin. 2007, 33, 49-68.
244. Ragland JD, Valdez JN, Loughhead J, Gur RC, Gur RE. Functional magnetic resonance imaging of internal source monitoring in schizophrenia: Recognition with and without recollection. Schizophrenia Research. 2006; 87: 160-171.
245. Weiss EM, Kohler CG, Nolan KA, Czobor P, Volavka J, Platt MM, Brensinger C, Loughhead J, Delazer M, Gur RE, Gur RC. The Relationship between history of violent and criminal behavior and recognition of facial expression of emotions in men with schizophrenia and schizoaffective disorder. Journal of Aggressive Behavior, 2006, 32, 187-194.
246. Alvino C, Kohler CG, Barrett F, Gur RE, Gur RC, Verma R. Computerized measurement of facial expression of emotions in schizophrenia. J Neurosci Methods. 2007; 163: 350-361.
247. Habel U, Windischberger C, Derntl B, Robinson S, Kryspin-Exner I, Gur RC, Moser E. Amygdala activation and facial expressions: Explicit emotion discrimination versus implicit emotion processing. Neuropsychologia. 2007, 45, 2369-2377.
248. Gur RE, Nimgaonkar VL, Almasy L, Calkins ME, Ragland JD, Pogue-Guile MF, Kanes SJ, Blangero J, Gur RC. Neurocognitive Endophenotypes in a Multiplex Multigenerational Family Study of Schizophrenia, American Journal of Psychiatry, 2007, 164, 813-819.
249. Pinkham AE, Gur RE, Gur RC. Affect recognition deficits in schizophrenia: neural substrates and psychopharmacological implications. Expert Rev Neurother. 2007, 7, 807-816.
250. Turetsky BI, Kohler CG, Indersmitten T, Bhati MT, Charbonnier D, Gur RC. Facial emotion

recognition in schizophrenia: When and why does it go awry? Schizophr Res. 2007, 94, 253-263.

251. Fan Y, Gur RE, Gur RC, Wu X, Shen D, Calkins ME, Davatzikos C. Unaffected Family Members and Schizophrenia Patients Share Brain Structure Patterns: A High-Dimensional Pattern Classification Study. Biol Psychiatry. 2007 Jun 5; [Epub ahead of print]
252. Calkins ME, Dobie DJ, Cadenhead KS, Olincy A, Freedman R, Green MF, Greenwood TA, Gur RE, Gur RC, Light GA, Mintz J, Nuechterlein KH, Radant AD, Schork NJ, Seidman LJ, Siever LJ, Silverman JM, Stone WS, Swerdlow NR, Tsuang DW, Tsuang MT, Turetsky BI, Braff DL. The Consortium on the Genetics of Endophenotypes in Schizophrenia: model recruitment, assessment, and endophenotyping methods for a multisite collaboration. Schizophr Bull. 2007; 33: 33-48.
253. Halpern DF, Benbow CP, Geary DC, Gur RC, Hyde JS, and Gernsbacher MA. The science of sex differences in science and mathematics. Psychological Science in the Public Interest, 2007; 8: 1-51.
254. Kohler CG, Martin EA, Kujawski E, Bilker W, Gur RE, Gur RC. No effect of donepezil on neurocognition and social cognition in young persons with stable schizophrenia. Cognit Neuropsychiatry. 2007; 12: 412-421.
255. Wang J, Korczykowski M, Rao H, Fan Y, Pluta J, Gur RC, McEwen BS, Detre JA. Gender Difference in Neural Response to Psychological Stress. Soc Cogn Affect Neurosci. 2007, 24, 227-239.
256. Gur RE, Loughhead J, Kohler CG, Elliott MA, Lesko K, Ruparel K, Wolf DH, Bilker WB, Gur RC. Limbic activation associated with misidentification of fearful faces and flat affect in schizophrenia. Arch Gen Psychiatry. 2007, 64, 1356-1366.
257. Silver H, Goodman C, Bilker WB, Knoll G, Gur RC, Povar G. Suboptimal processing strategy and working-memory impairments predict abstraction deficit in schizophrenia. J Clin Exp Neuropsychol. 2007, 29, 823-830.
258. Greenwood TA, Braff DL, Light GA, Cadenhead KS, Calkins ME, Dobie DJ, Freedman R, Green MF, Gur RE, Gur RC, Mintz J, Nuechterlein KH, Olincy A, Radant AD, Seidman LJ, Siever LJ, Silverman JM, Stone WS, Swerdlow NR, Tsuang DW, Tsuang MT, Turetsky BI, Schork NJ. Initial heritability analyses of endophenotypic measures for schizophrenia: the consortium on the genetics of schizophrenia. Arch Gen Psychiatry. 2007, 64, 1242-1250.
259. Ragland JD, Moelter ST, Bhati MT, Valdez JN, Kohler CG, Siegel SJ, Gur RC, Gur RE. Effect of retrieval effort and switching demand on fMRI activation during semantic word generation in schizophrenia. Schizophr Res. 2008, 99, 312-23.
260. Wang P, Barrett F, Martin E, Milonova M, Gur RE, Gur RC, Kohler C, Verma R. Automated video-based facial expression analysis of neuropsychiatric disorders. J Neurosci Methods. 2008, 168, 224-238.
261. Loughhead J, Gur RC, Elliott M, Gur RE. Neural circuitry for accurate identification of facial

Ruben C. Gur, Ph.D.

Page 29

emotions. Brain Res. 2008, 1194, 37-44.

262. Hakun JG, Seelig D, Ruparel K, Loughead JW, Busch E, Gur RC, Langleben DD. fMRI investigation of the cognitive structure of the Concealed Information Test. Neurocase. 2008; 14: 59-67.
263. Leitman DI, Loughead J, Wolf DH, Ruparel K, Kohler CG, Elliott MA, Bilker WB, Gur RE, Gur RC. Abnormal Superior Temporal Connectivity During Fear Perception in Schizophrenia. Schizophr Bull. 2008, 34, 673-678.
264. Green MF, Penn DL, Bentall R, Carpenter WT, Gaebel W, Gur RC, Kring AM, Park S, Silverstein SM, Heinssen R. Social Cognition in Schizophrenia: An NIMH Workshop on Definitions, Assessment, and Research Opportunities. Schizophr Bull. 2008, 34, 1211-1220.
265. Hakun JG, Ruparel K, Seelig D, Busch E, Loughead JW, Gur RC, Langleben DD. Towards clinical trials of lie detection with fMRI. Soc Neurosci. 2008, 12, 1-10.
266. Ray R, Loughead J, Wang Z, Detre J, Yang E, Gur R, Lerman C. Neuroimaging, genetics and the treatment of nicotine addiction. Behav Brain Res. 2008, 193, 159-169.
267. Dickinson D, Ragland JD, Gold JM, Gur RC. General and specific cognitive deficits in schizophrenia: Goliath defeats David? Biol Psychiatry. 2008, 64, 823-827.
268. Almasy L, Gur RC, Haack K, Cole SA, Calkins ME, Peralta JM, Hare E, Prasad K, Pogue-Geile MF, Nimgaonkar V, Gur RE. A Genome Screen for Quantitative Trait Loci Influencing Schizophrenia and Neurocognitive Phenotypes. Am J Psychiatry. 2008, 165, 1185-1192.
269. Horan WP, Braff DL, Nuechterlein KH, Sugar CA, Cadenhead KS, Calkins ME, Dobie DJ, Freedman R, Greenwood TA, Gur RE, Gur RC, Light GA, Mintz J, Olincy A, Radant AD, Schork NJ, Seidman LJ, Siever LJ, Silverman JM, Stone WS, Swerdlow NR, Tsuang DW, Tsuang MT, Turetsky BI, Green MF. Verbal working memory impairments in individuals with schizophrenia and their first-degree relatives: Findings from the Consortium on the Genetics of Schizophrenia. Schizophr Res. 2008, 103, 218-228.
270. Pinkham AE, Sasson NJ, Calkins ME, Richard J, Huggett P, Gur RE, Gur RC. The other-race effect in face processing among African American and Caucasian individuals with schizophrenia. Am J Psychiatry. 2008, 165, 639-645.
271. Kohler CG, Loughead J, Ruparel K, Indersmitten T, Barrett FS, Gur RE, Gur RC. Brain activation during eye gaze discrimination in stable schizophrenia. Schizophr Res. 2008, 99, 286-293.
272. Fan Y, Gur RE, Gur RC, Wu X, Shen D, Calkins ME, Davatzikos C. Unaffected family members and schizophrenia patients share brain structure patterns: a high-dimensional pattern classification study. Biol Psychiatry. 2008, 63, 118-124.
273. Carter CS, Barch DM, Gur RC, Gur RE, Pinkham A, Ochsner K. CNTRICS Final Task Selection: Social Cognitive and Affective Neuroscience-Based Measures. Schizophr Bull. 2008, 35, 153-62.

274. Russ JB, Gur RC, Bilker WB. Validation of affective and neutral sentence content for prosodic testing. Behav Res Methods. 2008, 40, 935-939.
275. Dyck M, Winbeck M, Leiberg S, Chen Y, Gur RC, Mathiak K. Recognition profile of emotions in natural and virtual faces. PLoS ONE. 2008, 3, e3628.
276. Talkowski ME, McClain L, Allen T, Bradford LD, Calkins M, Edwards N, Georgieva L, Go R, Gur RE, Gur RC, Kirov G, Chowdari K, Kwentus J, Lyons P, Mansour H, McEvoy J, O'Donovan MC, O'Jile J, Owen MJ, Santos A, Savage R, Toncheva D, Vockley G, Wood J, Devlin B, Nimgaonkar VL. Convergent patterns of association between phenylalanine hydroxylase variants and schizophrenia in four independent samples. Am J Med Genet B Neuropsychiatr Genet. 2008, 150B, 560-569
277. Kohler CG, Martin EA, Milonova M, Wang P, Verma R, Brensinger CM, Bilker W, Gur RE, Gur RC. Dynamic evoked facial expressions of emotions in schizophrenia. Schizophr Res. 2008, 105, 30-39.
278. Kohler CG, Martin EA, Stolar N, Barrett FS, Verma R, Brensinger C, Bilker W, Gur RE, Gur RC. Static posed and evoked facial expressions of emotions in schizophrenia. Schizophr Res. 2008, 105, 49-60.
279. Wild J, Gur RC. Verbal memory and treatment response in post-traumatic stress disorder. Br J Psychiatry. 2008, 193, 254-255.
280. Mathersul D, Palmer DM, Gur RC, Gur RE, Cooper N, Gordon E, Williams LM. Explicit identification and implicit recognition of facial emotions: II. Core domains and relationships with general cognition. J Clin Exp Neuropsychol. 2008, 19, 1-14.
281. Williams LM, Mathersul D, Palmer DM, Gur RC, Gur RE, Gordon E. Explicit identification and implicit recognition of facial emotions: I. Age effects in males and females across 10 decades. J Clin Exp Neuropsychol. 2008, 19, 1-21.
282. Turetsky BI, Greenwood TA, Olincy A, Radant AD, Braff DL, Cadenhead KS, Dobie DJ, Freedman R, Green MF, Gur RE, Gur RC, Light GA, Mintz J, Nuechterlein KH, Schork NJ, Seidman LJ, Siever LJ, Silverman JM, Stone WS, Swerdlow NR, Tsuang DW, Tsuang MT, Calkins ME. Abnormal auditory n100 amplitude: a heritable endophenotype in first-degree relatives of schizophrenia probands. Biol Psychiatry. 2008, 64, 1051-1059.
283. Derntl B, Windischberger C, Robinson S, Lamplmayr E, Kryspin-Exner I, Gur RC, Moser E, Habel U. Facial emotion recognition and amygdala activation are associated with menstrual cycle phase. Psychoneuroendocrinology. 2008, 33, 1031-1040.
284. Gur RC, Ragland JD, Reivich M, Greenberg JH, Alavi A, Gur RE. Regional Differences in the Coupling between Resting Cerebral Blood Flow and Metabolism may Indicate Action Preparedness as a Default State. Cereb Cortex. 2009, 19, 375-382.
285. Wiener HW, Klei L, Irvin MD, Perry RT, Aliyu MH, Allen TB, Bradford LD, Calkins ME, Devlin B, Edwards N, Gur RE, Gur RC, Kwentus J, Lyons PD, McEvoy JP, Nasrallah HA,

Ruben C. Gur, Ph.D.

Page 31

Nimgaonkar VL, O'Jile J, Santos AB, Savage RM, Go RC. Linkage analysis of schizophrenia in African-American families. Schizophr Res. 2009, 109, 70-79.

286. Patterson F, Jepson C, Strasser AA, Loughhead J, Perkins KA, Gur RC, Frey JM, Siegel S, Lerman C. Varenicline Improves Mood and Cognition During Smoking Abstinence. Biol Psychiatry. 2009, 65, 144-149.
287. Watanabe K, Matsui M, Matsuzawa J, Tanaka C, Noguchi K, Yoshimura N, Hongo K, Ishiguro M, Wanatabe S, Hirono K, Uese K, Ichida F, Origasa H, Nakazawa J, Oshima Y, Miyawaki T, Matsuzaki T, Yagihara T, Bilker W, Gur RC. Impaired neuroanatomic development in infants with congenital heart disease. J Thorac Cardiovasc Surg. 2009, 137, 146-153.
288. Derntl B, Windischberger C, Robinson S, Kryspin-Exner I, Gur RC, Moser E, Habel U. Amygdala activity to fear and anger in healthy young males is associated with testosterone. Psychoneuroendocrinology. 2009, 34, 687-693.
289. Loughhead J, Wileyto EP, Valdez JN, Sanborn P, Tang K, Strasser AA, Ruparel K, Ray R, Gur RC, Lerman C. Effect of abstinence challenge on brain function and cognition in smokers differs by COMT genotype. Mol Psychiatry. 2008, Dec 9. [Epub ahead of print]
290. Prasad KM, Almasy L, Gur RC, Gur RE, Pogue-Geile M, Chowdari KV, Talkowski ME, Nimgaonkar VL. RGS4 Polymorphisms Associated With Variability of Cognitive Performance in a Family-Based Schizophrenia Sample. Schizophr Bull. 2009 Mar 12. [Epub ahead of print]
291. Glocker ML, Langleben DD, Ruparel K, Loughhead JW, Valdez JN, Griffin MD, Sachser N, Gur RC. Baby schema modulates the brain reward system in nulliparous women. Proc Natl Acad Sci U S A. 2009 May 18. [Epub ahead of print]
292. Eack SM, E Mermon D, Montrose DM, Miewald J, Gur RE, Gur RC, Sweeney JA, Keshavan MS. Social Cognition Deficits Among Individuals at Familial High Risk for Schizophrenia. Schizophr Bull. 2009 Apr 14. [Epub ahead of print]

Contributions to peer-reviewed clinical research publications, participation cited but not by authorship:

None.

Research Publications, non-peer reviewed: None.

Abstracts: (Excluding abstracts subsequently published as full-length papers; Past 3 years only)

1. Gur RE, Almasy L, Nimgaonkar V, Gur RC, Turetsky BI. Endophenotypic measures in disorders of complex behavior. Society of Biological Psychiatry, Philadelphia, Pennsylvania, 2002.
2. Kurtz M, Moberg PJ, Gur RC, Gur RE. Remediation of Wisconsin Card Sorting Test performance in patients with schizophrenia: A Meta-analysis. The International Neuropsychological Society, Toronto, Canada, 2002.

3. Siegel SJ, Winey Pierre J, Liang Y, Irani F, Maxwell C, Salama R, Weightman BD, Kirshner M, Pollock B, Lewis D, Gur RC, Gur RE. Title: Surgically implantable antipsychotic medication: release kinetics in animals and patient attitudes towards long-term delivery devices. American College of Neuropsychopharmacology, San Juan, Puerto Rico, 2002.
4. Calkins ME, Gur RC, Ragland JD, Gur RE. Face recognition memory deficits in schizophrenia patients and their relatives: Comparison with visual object memory performance. International Congress on Schizophrenia Research, Colorado Springs, Colorado, 2003.
5. Gur RE, Turetsky BI, Ragland JD, Gur RC. Habituation of the hemodynamic response during novelty detection in schizophrenia. International Congress on Schizophrenia Research, Colorado Springs, Colorado, 2003.
6. Kurtz M, Moberg PJ, Ragland JD, Gur RC, Gur RE. Symptoms versus neurocognitive test performance as predictors of psychosocial status in schizophrenia: A 1- and 4-year prospective study. International Congress on Schizophrenia Research, Colorado Springs, Colorado, 2003.
7. Lowery N, Ragland JD, Indersmitten T, Gur RE, Gur RC. The contribution of controlled aspects of semantic processing to verbal memory encoding and semantic fluency deficits in schizophrenia. International Congress on Schizophrenia Research, Colorado Springs, Colorado, 2003.
8. Kurtz M, Ragland JD, Moberg PJ, Gur RC. The Penn Conditional Exclusion Test: A New Measure of Executive Function With Alternative Forms for Repeat Administration. 31st Annual International Neuropsychological Society Conference, Honolulu, Hawaii, 2003.
9. Ragland JD, Gur RC, Valdez J, Gur RE. Effect of schizophrenia on frontotemporal activity during word encoding and recognition: An event- related fMRI study. International Congress on Schizophrenia Research, Colorado Springs, Colorado, 2003.
10. Calkins ME, Moberg PJ, Gur RC, Gur RE, Turetsky BI. Memory-delineated subtypes of schizophrenia: Performance in biological relatives. Society of Biological Psychiatry Annual Meeting, New York, New York, 2004.
11. Gur RC, Verma R, Davatzikos C, Gur RE. Using DTI to test hypotheses on sex differences in brain organization. New York Academy of Sciences Diffusion Tensor Imaging Workshop. New York, New York, August, 2004.
12. Gur RE, Almasy L, Nimgaonkar V, Pogue-Geile M, Ragland JD, Blangero J, Gur RC. Pleiotropic genetic effects in multiplex multigenerational families with schizophrenia on endophenotypic measures of memory and emotion processing. Society for Neuroscience, San Diego, California, 2004.
13. Gur RC, Verma R, Loughhead J, Davatzikos C, Kohler C, Gur RE. Face processing as a tool for probing the neurobiology of affect: Methods and initial results. 43rd Annual Meeting of

the American College of Neuropsychopharmacology, San Juan, Puerto Rico, 2004.

14. Irani F, Dankert M, Brensinger C, Bilker WB, Nair NR, Kohler CG, Kanes SJ, Turetsky BI, Moberg PJ, Ragland JD, Gur RC, Gur RE, Siegel SJ. Patient attitudes towards surgically-implantable, long-term delivery of psychiatric medicine. American Psychiatric Association annual meeting New York, New York, 2004.
15. Moelter ST, Ragland JD, Friedman K, Moberg PJ, Gur RC, Gur RE, Turetsky BI. Does animal fluency reveal cognitive and neuroanatomical heterogeneity in schizophrenia? 33rd annual meeting of the International Neuropsychological Society, St.Louis, Missouri, 2004.
16. Ragland JD, Valdez J, Gur RC, Elliott M, Gur RE. Effect of schizophrenia on fMRI activity during shallow and deep word encoding. Human Brain Mapping, Budapest, Hungary, 2004.
17. Ragland JD, Valdez J, Loughhead J, Gur RC, Elliot M, Gur RE. Diffuse cortical and sub-cortical over-activation during source monitoring in schizophrenia. 43rd Annual Meeting of the American College of Neuropsychopharmacology, San Juan, Puerto Rico, 2004.
18. Ragland JD, McCarthy E, Valdez J, Brensinger C, Bilker WB, Gur RC, Gur RE. Levels-of-processing effect on source monitoring in schizophrenia. 43rd Annual Meeting of the American College of Neuropsychopharmacology, San Juan, Puerto Rico, 2004.
19. Moelter ST, Kohler C, Ragland JD, Gur RC. Progression of Neuropsychological Deficits in a Case of Marchiafava-Bignami Disease. International Neuropsychological Society, Baltimore, Maryland, 2004.
20. Stewart CA, Cerhan J, Ragland JD, Gur RC, Smith G. Correlates Between Traditional and Computerized Neuropsychological Testing in Hepatic Encephalopathy. The Liver Meeting, Boston, Massachusetts, 2004.
21. Gur RC, Davatzikos C, Shen D, Xiaoyng W, Fan Y, Hughett P, Turetsky BI, Gur RE. Whole-brain deformation based morphometry MRI study of schizophrenia. International Congress on Schizophrenia Research, Savannah, Georgia, 2005.
22. Gur RE, Calkins ME, Ragland JD, Richard J, Gur RC. Neurocognitive measures in genetic studies of schizophrenia. International Congress on Schizophrenia Research, Savannah, Georgia, 2005.
23. Gur RE, Laura Almasy L, Kohler C, Gur RC. Emotion processing as an endophenotypic measure in family studies of schizophrenia. World Congress of Biological Psychiatry, Vienna, Austria, 2005.
24. Ragland JD, Moelter ST, Valdez J, Gur RC, Gur RE. Controlled versus automatic semantic retrieval in schizophrenia: A compressed image acquisition overt word production fMRI study. International Congress on Schizophrenia Research, Savannah, Georgia, 2005.

Editorials, Reviews, Chapters, including participation in committee reports:

1. Gur RE, Gur RC. Correlates of conjugate lateral eye movement behavior in humans. In S. Harnad et al (eds.), Lateralization in the nervous system. New York: Academic Press, 1976.
2. Gur RE, Levy J, Gur RC. Clinical studies of brain organization and behavior. In A. Frazer, A. Winokur (eds.), Biological basis of psychiatric disorders. New York: Spectrum, 1977.
3. Sackeim HA, Gur RC. Self-confrontations, self-deception and consciousness. In G.E. Schwartz, D. Shapiro (eds.), Consciousness and self-regulation: advances in research. New York: Plenum Press, 1978.
4. Gur RC. Imagery, absorption and the tendency toward "mind exploration" as correlates of hypnotic susceptibility in males and females. In F.H. Frankel, H.S. Zamansky (eds.), Hypnosis at its bicentennial: selected papers. New York: Plenum, 1978.
5. Gur RC, Gur RE. Handedness and individual differences in hemispheric activation. In J. Herron (ed.), The Neuropsychology of left-handedness. New York: Academic Press, 1979.
6. Levy J, Gur RC. Individual differences in psychoneurological organization. In J. Herron (ed.), The neuropsychology of left-handedness. New York: Academic Press, 1979.
7. Sackeim HA, Gur RC. Facial symmetry, perceiver biases and the communication of emotion. In J.T. Cacioppo, R.E. Petty (eds.), Social Psychophysiology. New York: Guilford, 1983.
8. Gur RC. Measurement and imaging of regional brain function: Implications for neuropsychiatry. In P. Flor-Henry, J. Gruzelier (eds.), Laterality and psychopathology. Amsterdam: Elsevier, 1983.
9. Reivich M, Gur RC. Sensory and psychological effects on local glucose metabolism in humans. In M. Reivich (ed.), Positron emission tomography. New York: Liss, 1985.
10. Gur RC, Gur RE, Sussman NM, Selzer M. Positron emission tomography in epilepsy. In M. Reivich (ed.), Positron emission tomography. New York: Liss, 1985.
11. Gur RC. Measurement of regional brain physiology in humans: early applications in behavioral neurology. In M-M. Mesulam (ed.), Principles of behavioral neurology. Philadelphia: F.A. Davis, 1985.
12. Alavi A, Chawluk JB, Hurtig HI, Dann RW, Saykin AJ, Gur RC, Reivich M. Determination of regional cerebral function and structure in normal aging and dementia with positron emission tomography (PET), magnetic resonance imaging (MRI) and x-ray computed tomography (XCT). In H. Hafner, G. Moschel, N. Sartorius (eds.), Mental health in the elderly. Heidelberg: Springer-Verlag, 1985.
13. Gur RC, Gur RE. Hemispheric specialization and regional cerebral blood flow. In A. Glass (ed.), Individual differences in hemispheric specialization. New York: Plenum Publications, 1987.
14. Gur RC. Imaging the activity of the human brain. National Forum, 1987, 67, 13-16.

15. Gur RC. Integration of multifaceted data on regional brain function: from metabolic images to behavioral images. In R. Takahashi, P. Flor-Henry, J. Gruzelier, S. Niwa (eds.), Cerebral dynamics, laterality and psychopathology. Amsterdam: Elsevier, 1987.
16. Gur RC. Atlas of brain imaging: The 133-Xenon inhalation technique. Masters in Psychiatry, 1987.
17. Gur RC, Gur RE, Saykin AJ. The neuropsychological study of schizophrenia. In C.A. Tamminga, S.C. Schulz (eds.), Advances in Neuropsychiatry and Psychopharmacology, Vol 1. Schizophrenia Research. New York: Raven Press, 1991, pp.153-162.
18. Gur RC, Gur RE. The use of neuroimaging techniques in brain injury. In J. Dywan, R. Kaplan (eds.), Neuropsychology and the Law. New York:Springer-Verlag, 1991.
19. Gur RC, Gur RE. The impact of neuroimaging on human neuropsychology. In R.G. Lister, H.J. Weingartner (eds.), Perspectives on Cognitive Neuroscience. Oxford University Press, 1991, 23, 417-435.
20. Gur RC, Gur RE. Laterality in schizophrenia: PET studies. In N.D. Volkow (ed), Positron Emission Tomography in Schizophrenia, 1991, 3, 47-58.
21. Gur RC, Saykin AJ, Gur RE. Neuropsychological assessment in psychiatric research and practice. In S.B. Guze, J. Helzer (eds), Psychiatry, 1991, 72, 1-16.
22. Gur RC, Gur RE. Neurobehavioral and neuroimaging data in the medical-legal context. In H.V. Hall, R.J. Sbordone (eds.), Disorders of Executive Functions: Civil and Criminal Law Applications, 1993, 4, 107-122.
23. Gur RC. Neuropsychological methods for evaluating regional brain dysfunction. In A. Wilner (ed.), Cerebral Damage Before and After Cardiac Surgery. England: Kluwer, 1993, 8, 101-111.
24. Gur RC, Gur RE, Saykin AJ. Behavioral Imaging: The Neuropsychological Assessment. In K. Maurer (ed.), Imaging of the Brain in Psychiatry and Related Fields. New York: Springer-Verlag, 1993, 351-361.
25. Gur RC, Saykin AJ, Gur RE. Brain function in schizophrenia: application of neurobehavioral studies. In N.C. Andreasen (ed.), Schizophrenia: From Mind to Molecule, 1994, 5, 93-104.
26. Gur RC, Gur RE. Methods for the study of brain-behavior relationships. In A. Frazer, P.B. Molinoff, A. Winokur (eds.), Biological Bases Of Brain Function and Disease. Raven Press. 1994, 15, 261-279.
27. Gur RC, Gur RE. The potential of physiological neuroimaging for the study of schizotypy: experiences from applications to schizophrenia. In A. Raine, T. Lencz, S.A. Mednick (eds.), Schizotypal Personality. Cambridge University Press, 1995, 17, 406-425.

30. Gur RC, Gutierrez JM, Holdnack JA, Mahr RN. Neurobehavioral probes as applied in physiologic neuroimaging studies: Methodologic considerations. In E.D. Bigler (ed.), Handbook of Human Brain Function: Neuroimaging. New York: Plenum Press, 1996, 10, 199-214.
31. Gur RC, Moberg PJ, Gur RE. Aging and cognitive functioning. In R. Lavizzo-Mourey, M. Forcica (eds.), Geriatric Secrets, 1996, 26, 126-129. 3<sup>rd</sup> Edition in press.
32. Gur RE, Gur RC. Blood flow and metabolism in schizophrenia. In R. Mathew (ed.), Cerebral Blood Flow in Neuropsychiatric Disorders. Great Neck, NY: PMA Publishing Corp., in press.
33. Gur RE, Gur RC. Schizophrenia: Brain Structure and Function. In H.I. Kaplan, B.J. Sadock (eds.), Comprehensive Textbook of Psychiatry/VII, Philadelphia: Lippincott Williams & Wilkins, 2000.
34. Gur RC, Cowell P, Gur RE. Gender Differences in Neuropsychological Testing. To appear in L.J. Dickstein, B.L. Kennedy (eds.), Gender Differences in the Brain: Linking Biology to Psychiatry. New York: Guilford Publications, Inc.
35. Gur, R.C., Moelter, S.T., Ragland, JD. "Learning and memory in schizophrenia". In, Sharma, T., & Harvey, P. (Eds.), Cognition in Schizophrenia. Oxford University Press: Oxford, G.B., 1999.
36. Gur RC, Gur RE. Neuroimaging applications in the elderly. American Journal of Geriatric Psychiatry, 2002, 10, 5-11.
37. Gutierrez, JM and Gur, RC. A computerized forced-choice method for detection of malingering. in: CR Reynolds (Editor) Detection of During Head Injury Litigation (Critical Issues in Neuropsychology). New York: Planum 1998.

#### COMMENTARIES:

1. Gur RC. Measuring hypnotic susceptibility: A guest editorial. American Journal of Clinical Hypnosis, 1979, 21, No. 2 and 3, (October 1978/January 1979). (Two issues devoted to the psychometrics of hypnotizability, edited by RC Gur).
2. Gur RE, Gur RC. A note on Levick and Voneida: Eye movements in schizophrenics vs. normal subjects. Archives of General Psychiatry, 1979, 36, 493-494.
3. Sackeim HA, Gur RC. Asymmetry in facial expression. Science, 1980, 209, 834-836.
4. Sackeim HS, Gur RC. Voice recognition and the ontological status of self-deception. Journal of Personality and Social Psychology, 1985, 48, 1365-1368.
5. Gur RE, Skolnick BE, Gur RC. Gruzelier's "reconsideration" considered. (Response to J. Gruzelier's reconsideration of Gur et al [1983] conclusions). Archives of General Psychiatry, 1985, 42, 633.
6. Saykin AJ, Gur RC. A review of Neuropsychological Assessment of Neuropsychiatric

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Disorders. In I. Grant, K.M. Adams (eds.), New York, Oxford University Press, 1986.

7. Gur RC. Do we have a research method for studying self reports? A review of A. Giorgi (ed.), Phenomenology and psychological research. Contemporary Psychology: A Journal of Reviews, 1987, 32, 547-548.
8. Nasrallah HA, Mitchell AJ, Gur RE, Gur RC, Turetsky BI, Cannon TD, Mozley PD. Brain and CSF Volume Differences in Schizophrenic Subtypes. American Journal of Psychiatry, 1995, 152, 817-818.
9. Gur RC, Gur RE. Hypofrontality in schizophrenia: RIP. The Lancet, 1995, 345, 1383-1384.
10. Lenkinsky RE & Gur RC. MRS: A novel tool for studying brain function. Contemporary Psychology: A Journal of Reviews, 1997, 42, 351-352.
11. Moberg, P.J., Doty, R.L., Turetsky, B.I., Arnold, S.E., Mahr, R.N., Gur, R.C., Bilker, W., & Gur, R.E. . Olfactory identification abilities deteriorate in patients with schizophrenia, even for those with relatively recent onset [letter; reply]. American Journal of Psychiatry, 1998, 155, 1463-1464.
12. Gur RC & McBride, T. Toward a unitary description of neuropsychological functions: a review of Handbook of Clinical and Experimental Neuropsychology Edited by Gianfranco Denes and Luigi Pizzamiglio. Contemporary Psychology, 2000, 45, 682-683.

#### BOOKS:

Gur RE, Andreasen NA, Asarnow R, Gur RC, Jones P, Kendler K, Matcheri K, Lieberman J, McCarley R, Murray R, Rapoport J, Tamminga C, Tsuang M, Walker E, Weinberger D. Commission on Schizophrenia. In D.L. Evans, E. Foa, R.E. Gur, H. Hendrin, C. O'Brien, M. Seligman, B.T. Walsh, (Eds), Treating and Preventing Adolescent Mental Health Disorders: What We Know and What We Don't Know. New York: Oxford University Press, The Annenberg Foundation Trust at Sunnylands, and the Annenberg Public Policy Center of the University of Pennsylvania, 2005.

#### PATENT:

Gur RC, Gur RE, Trivedi SS. "Behavioral Imaging: Topographic Display of Neuropsychological Data, U.S. Patent No. 4862359.



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February 17, 2008

Paul Bottei, Esq.  
Michael Passino, Esq.

**Re.: Analysis of neurocognitive, MRI, and PET results for Mr. John Hall**

Dear Mr. Bottei and Mr. Passino:

At your request I have performed a quantitative analysis of the neuropsychological testing performed by Dr. Pamela Auble, Ph.D. ABPP-CN, and the magnetic resonance imaging (MRI) and positron emission tomography (PET) studies performed on Mr. Hall at Vanderbilt University Medical Center. I will summarize some background information relevant to the likelihood that Mr. Hall suffers from brain damage that can relate to his behavior.

**NEUROPSYCHOLOGICAL TESTING**

Mr. Hall received a psychological evaluation performed by Dr. Pamela Auble, Ph.D. ABPP-CN, in August 2002 that included the Wechsler Adult Intelligence Scale (WAIS). Findings from the assessment revealed overall intellectual functioning in the average range. We have applied the "Behavioral Imaging" algorithm<sup>1</sup> to further establish the localization of brain damage based on the neuropsychological test scores. The process for this schematic representation of clinical data has been demonstrated to be clinically reliable and stable in defining and localizing affected areas of neurological impairment. The technology permits clinical professionals to effectively determine the regional distribution of deficits identified in standard neuropsychological tests, and thus assist in the diagnosis, treatment, and study a variety of brain disorders, including Parkinson's Disease, Alzheimer's Disease, Schizophrenia, and neurodevelopmental disorders. The image is a true topographic display of the neuropsychological data in reference to the dysfunctional areas and severity of impairment. The image in **Figure 1** depicts three views of Mr. Hall's brain from the left (top left panel), the right (lower left panel) and the top (right panel, with the front of the brain oriented toward the top of the panel). The scale in the lower right of the image represents functional capacity relative to the most intact ability. It is expressed as deviations away from normal regional

<sup>1</sup> Gur RC, Trivedi SS, Saykin AJ, Gur RE. "Behavioral imaging" - a procedure for analysis and display of neuropsychological test scores: I. Construction of algorithm and initial clinical evaluation. *Neuropsychiatry, Neuropsychology and Behavioral Neurology*, 1988, 1, 53-60; Gur RC, Saykin AJ, Blonder LX, Gur RE. "Behavioral imaging": II. Application of the quantitative algorithm to hypothesis testing in a population of hemiparkinsonian patients. *Neuropsychiatry, Neuropsychology and Behavioral Neurology*, 1988, 1, 87-96; Gur RC, Saykin AJ, Benton A, Kaplan E, Levin H, Kester DB, Gur RE. "Behavioral imaging": III. Inter-rater agreement and reliability of weightings. *Neuropsychiatry, Neuropsychology, and Behavioral Neurology*, 1990, 3, 113-124; Blonder LX, Gur RE, Gur RC, Saykin AJ, Hurtig HI. "Neuropsychological functioning in hemiparkinsonism." *Brain and Cognition*, 1989, 9, 177-190.

variability, with the result that the behavioral image of a normal, intact brain would produce a fairly uniform orange-pink color. As can be seen in Mr. Hall's BI, his brain is compromised bilaterally, with more pronounced abnormalities in fronto-temporal regions on the left. The damage to medial temporal lobe structures extends both frontally and parietally. The pattern of deficits is consistent with the effects of a lateral blow to the head but could also reflect neurodevelopmental abnormalities.

### MRI RESULTS

The magnetic resonance (MR) images of Mr. Hall were examined via delineation of 92 regions of interest (ROI), which was assisted by a semi-automated template-warping algorithm.<sup>2</sup> This analysis revealed that Mr. Hall has an "unusual brain structure" (Dr. Davatzikos analysis), with several parenchymal abnormalities. Examination of volumes of individual structures (Figure 2) revealed that Mr. Hall's "brain volumes are significantly lower than what expected from a person in that age range, especially in the frontal lobe". As can be seen in Figure 2, the volumes of both frontal lobes is reduced by more than 2 SDs and the right frontal is reduced by nearly 3SDs. Within the frontal lobe the right inferior frontal is especially reduced, as is right medial gray matter overall. Such volume reductions are consistent with atrophy induced by head injury. Ventricular volume is abnormally high bilaterally (nearly 3SDs above normal), which indicates loss of tissue in medial structures. This is consistent with head injury, but is also found with high prevalence in neurodevelopmental disorders such as schizophrenia.

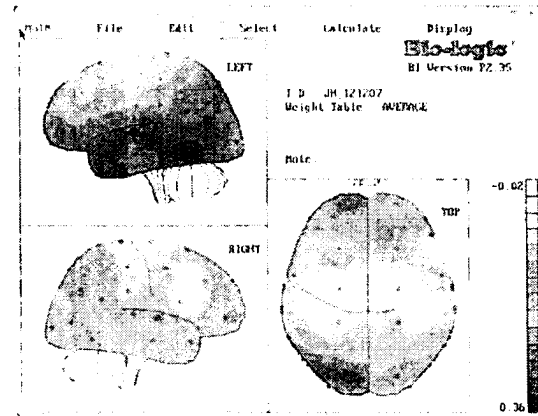
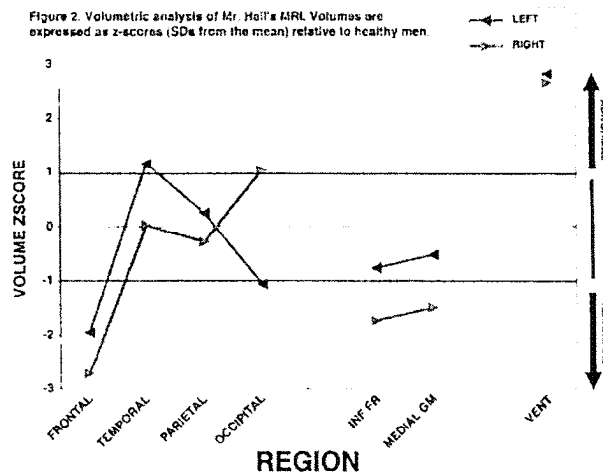


Figure 1. Behavioral image of Mr. Hall's neuropsychological performance based on the tests administered by Dr. Auble.

The analysis indicates structural damage in regions with significant relevance to behavior, especially related to the regulation of emotions. The reduced volume in inferior frontal cortex suggests impaired ability to control emotions and adjust response to the context. Medial gray matter is involved in memory, the perception of threat and the response to it. The combined effect of damage to medial gray matter and inferior frontal regions would substantially impair the ability to interpret emotionally relevant information and inhibit impulsive behavior.

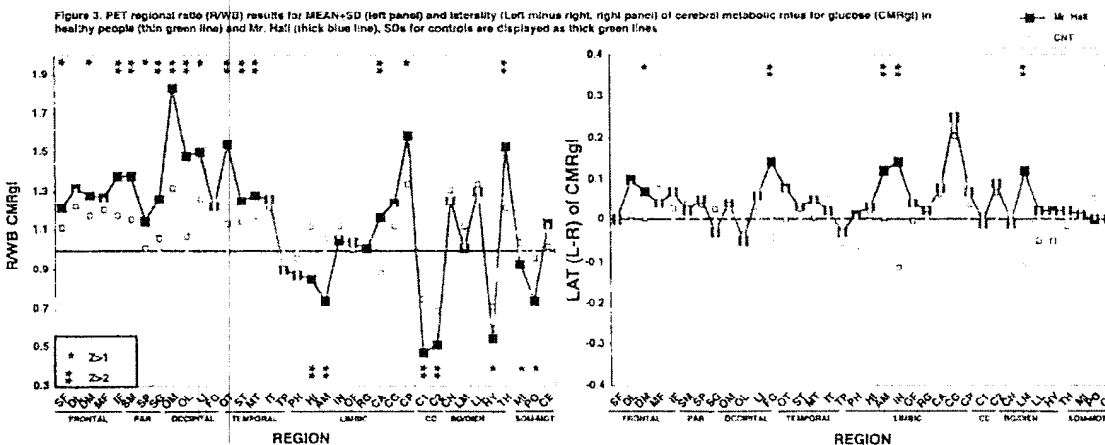
### PET RESULTS

The positron emission tomography (PET) study, which examined the regional distribution of glucose metabolic activity using fluorine-18 labeled deoxyglucose



<sup>2</sup> D. Shen, C. Davatzikos, IEEE Transactions on Medical Imaging 21, 1421-1439 (November, 2002).

(FDG), was subjected to a quantitative analysis using a standard "regions of interest" (ROI) approach.<sup>3</sup> The quantitative analysis of count rates relative to whole brain is shown in **Figure 3** (abbreviations of ROI labels are spelled out on the last page of this report). This analysis indicated abnormal metabolism in 22 of the 36 regions, which is a highly significant proportion ( $p < 0.00001$ ). There was substantial and significant relative increase in much of the frontal, temporal parietal and occipital cortex, as well as anterior and posterior cingulate cortex and the thalamus, but decrease in hippocampus and amygdala, and subcortical regions including hypothalamus, midbrain and pons. There is reduced metabolism in the corpus callosum both anteriorly and posteriorly. The laterality index showed abnormalities in fewer regions (only 6 of the 36), but in all of them it reflected lower right than left metabolism and in 4 of these regions the difference was highly significant. Notably, the amygdala, which is at the epicenter of the emotion processing circuitry, shows both volume reduction and abnormal asymmetry. The insula is also reduced in activity on the right compared to left. The insula is especially important for integration of bodily representations in creating subjective emotional experiences. The combined effect of damage to amygdala, insular cortex and inferior frontal regions would substantially impair the ability to interpret emotionally relevant information and inhibit impulsive behavior.



These abnormalities indicate disturbed activity in regions that are important in regulation of emotions and behavioral control. Thus, the abnormal activity of frontal regions would disrupt executive functions and the ability to make behavior adjust to context. Disturbed amygdala and other limbic activity would impair the ability to interpret emotionally relevant information. Reduced corpus callosum activity would diminish the ability to integrate behavior interhemispherically, and abnormal basal ganglia activity would disrupt guidance of movements directly controlled by the frontal motor areas.

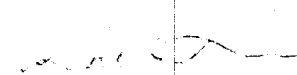
### SUMMARY AND OPINION

The quantitative analysis of the neuropsychological testing and of both structural neuroimaging (MRI) and functional neuroimaging (PET) studies of Mr. Hall's brain revealed abnormalities in frontal, limbic and associated regions relevant to behavior,

<sup>3</sup> Gur RC, Mozley LH, Mozley PD, Resnick SM, Karp JS, Alavi A, Arnold SE, Gur RE. Sex differences in regional cerebral glucose metabolism during a resting state. *Science*. 1995; 267:528-531.

especially related to the interpretation of emotionally relevant information and regulation of response. These abnormalities are of unclear etiology, but most likely related to anoxia or traumatic brain injury. However, some of the abnormalities indicate that Mr. Hall's brain may have been neurodevelopmentally compromised. Specifically, large ventricles as in his case have been strongly associated with neurodevelopmental disorders such as schizophrenia. The brain abnormalities are likely to impair Mr. Hall's ability to modulate his emotional behavior in response to situational demands, and likely underlie his cognitive deficits as documented in the neuropsychological evaluation.

Of course, please bear in mind that these impressions are based entirely on analysis of data, without knowledge on Mr. Hall's background or behavior. For a diagnosis I would need to review his medical, school and offense records and interview and test him myself. Within these limitations, the conclusions stated in this report are offered to a reasonable degree of scientific certainty. I hope this summary is helpful. Please let me know if you have questions or need further clarifications.



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Ruben C. Gur, PhD  
Professor of Neuropsychology

**Abbreviations in PET Figures:**

SF = Superior Frontal; DL = Dorsal Prefrontal – Lateral; DM = Dorsal Prefrontal – Medial; MF = Mid–Frontal; IF = Inferior Frontal; SM = Sensorimotor; SP = Superior Parietal; SG = Supramarginal Gyrus; OL = Occipital cortex, Lateral ; OM = Occipital cortex, Medial; LI = Lingual Gyrus; FG = Fusiform Gyrus; OT = Occipital Temporal; ST = Superior Temporal; MT = Mid–Temporal; IT = Inferior Temporal; TP = Temporal Pole; PH = Parahippocampal Gyrus; HI = Hippocampus; AM = Amygdala; IN = Insula; OF = Orbital Frontal; RG = Rectal Gyrus; CA = Cingulate Gyrus – Anterior; CG = Cingulate Gyrus - genu; CP = Cingulate Gyrus – Posterior; C1 = Corpus Callosum – Anterior; C2 = Corpus Callosum – Posterior; CN = Caudate Nucleus; LM = Lenticular – Medial [Globus Pallidus]; LL = Lenticular – Lateral [Putamen]; TH = Thalamus; HY=Hypothalamus; MI = Midbrain; PO = Pons; CE = Cerebellum.

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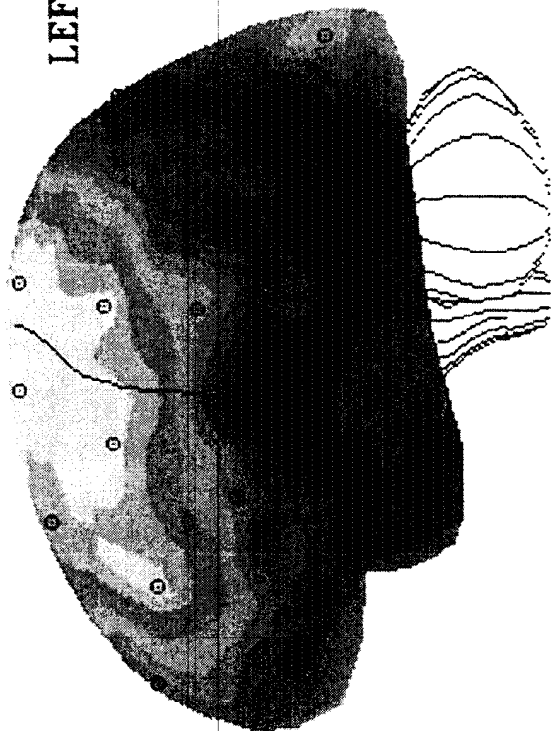
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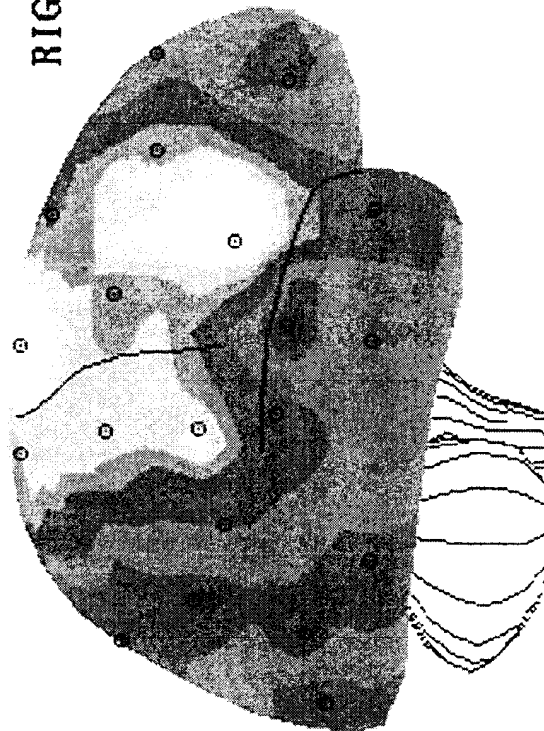
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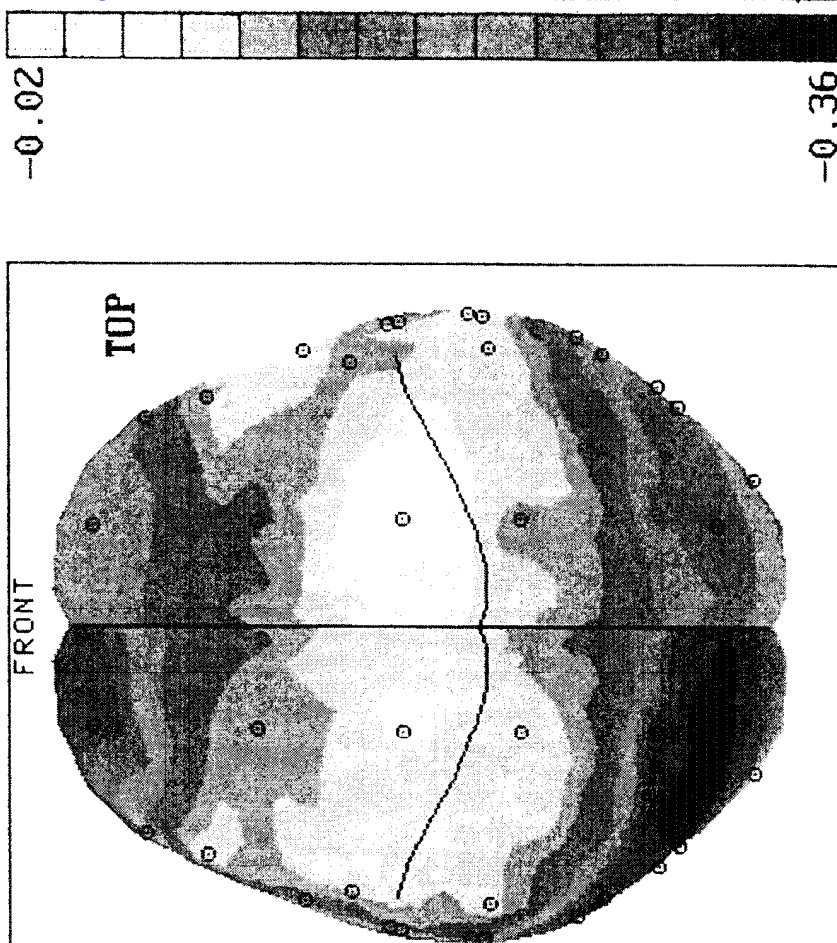


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